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PULP & PAPER

February 1985

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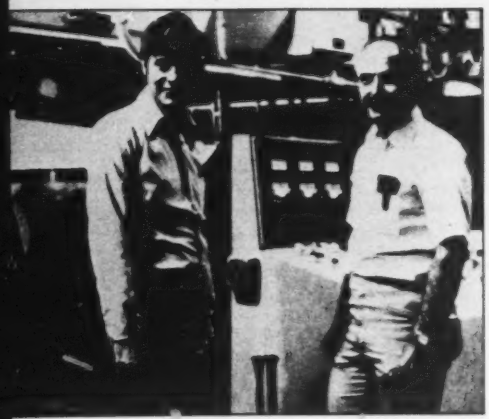

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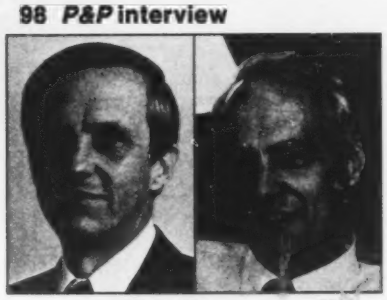

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PULP & PAPER (ISSN 0033-4081) is published monthly except November when semimonthly by MILLER FREEMAN PUBLICATIONS, 500 Howard St., San Francisco, Calif. 94105. Second class postage paid at San Francisco and at additional mailing office.
POSTMASTER: Please send Form 3579 to PULP & PAPER, 500 Howard St., San Francisco, Calif. 94105.
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ABP BPA

Subscriptions & Address Change: Sent without charge in the U.S.A. & Canada (upon written request) to individuals in pulp, paper, and board manufacturing firms and paper converting firms. To all others there is a subscription charge of $45.00 a year in the U.S. All subscriptions to other countries: $65.00 a year, except Europe and Mediterranean, $75.00 (air service included). Single copy, $4.00, except Buyers Guide, $25.00. Photocopies of articles and complete microform volumes available through University Microfilms International, 300 N. Zeeb Rd., Ann Arbor, Mich. 48106.
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Circulation Department, PULP & PAPER, 500 Howard St., San Francisco, Calif. 94105.
For address change, include label from recent issue.

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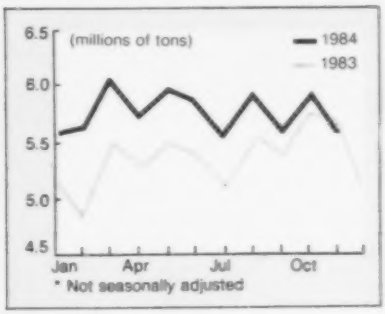
U.S. paper and board production, 1984/83



November production of U.S. paper and paperboard dipped below year-earlier levels for the first time in 1984, dropping 1.6% compared with November 1983, according to the American Paper Institute. Total production for the month was 5.6 million tons, bringing the annualized year-to-date total to 69.4 million tons, up 6.3% from 1983. According to weekly API data through Dec. 29, total 1984 production amounted to some 68.5 million tons, up 5.4% over record 1983 levels. Paper accounts for 34.3 million tons of that total, up 5.6% over 1983, and paperboard 34.2 million tons, up 6.3%.

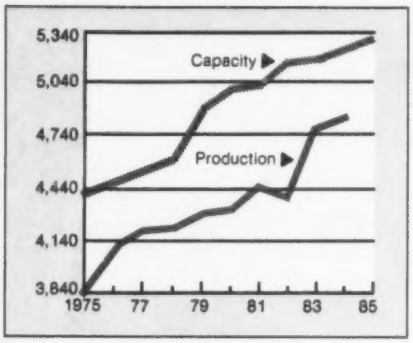
Among major grades, printing and writing papers showed some weakness in November compared with 1983, as did packaging papers, reflecting the fall slowdown in the economy. Containerboard production also declined from November 1983. Bleached board was up a modest 0.3% over 1983, however.

Canadian newsprint shipments in November totaled 770,000 metric tons, a gain of 0.5% over November 1983, said the Canadian Pulp & Paper Assn. Newsprint mill operating rates reached 95% in November, up from 91% in October. ■

	Latest month (000 short tons)		% change from year ago	Annualized year-to-date (000 short tons)	% change from year ago
PAPER & PAPERBOARD PRODUCTION[1]					
Newsprint	Nov.	460	1.5	5,579	7.5
Uncoated groundwood (s)	Nov.	127	−8.0	1,584	3.1
Coated paper (s)	Nov.	518	−4.1	6,232	9.8
Uncoated free sheet (s)	Nov.	729	−2.1	9,205	5.1
Other printing/writing	Nov.	122	—	1,482	5.2
Total packaging and other paper (s)	Nov.	428	−11.9	5,639	2.4
Tissue	Nov.	400	1.3	4,873	1.5
Total paper	**Nov.**	**2,783**	**−2.1**	**34,595**	**5.3**
Unbleached kraft paperboard	Nov.	1,307	−1.8	16,230	7.0
Semichemical medium	Nov.	411	−2.8	5,204	9.8
Bleached paperboard	Nov.	331	0.3	4,100	3.9
Recycled paperboard	Nov.	639	−0.9	8,075	8.3
Total paperboard	**Nov.**	**2,773**	**−1.1**	**34,779**	**7.3**
Total U.S. paper and paperboard output	**Nov.**	**5,556**	**−1.8**	**69,374**	**6.3**
PULP, WASTEPAPER & FIBER[2]					
Total U.S. woodpulp production	Oct.	4,798	2.6	56,083	6.7
Market pulp production	Oct.	635	7.6	6,865	5.7
Wastepaper consumption at paper/board mills	Oct.	1,389	5.1	15,947	9.8
Pulpwood consumption (cords)	Oct.	7,625	1.2	88,342	3.1
CONVERTED PRODUCTS STATISTICS[3]					
Corrugated box shipments (billion ft²)	Nov.	21.103	0.3	247.627†	6.8
Containerboard inventories at U.S. box plants and mills	Nov. 1	2,602	−3.7		
INTERNATIONAL TRADE[2]					
U.S. paper imports (including products)	Oct.	920	10.2	11,140	26.2
Imports of Canadian newsprint	Oct.	634	0.6	7,689†	13.6
U.S. paper exports (including products)	Oct.	359	3.5	4,531	−0.7
Exports of unbleached kraft linerboard	Nov.	112	−29.1	2,018	−12.1
Exports of woodpulp	Oct.	284	−9.8	3,610	—
Norscan pulp inventories[4]	Nov. 30	1,626	−0.1		
Norscan pulp operating rates[4]	Nov.	95%	93%	93%	91%
CANADIAN STATISTICS[5] *(reported in metric tons)*					
Total newsprint shipments	Nov.	770	0.5	8,261†	7.1
Operating rates		94%	95%	92%	85%
Inventories held by U.S. consumers	Nov. 30	1,376	12.9		
Other paper/board shipments	Nov.	445	2.1	4,813	8.3
Woodpulp shipments (export only)	Nov.	582	11.3	6,118†	0.6
Operating rates	Nov.	95%	91%	87%	86%

1. American Paper Institute. 2. API, Bureau of Census, American Pulpwood Assn. 3. Fiber Box Assn., Paperboard Packaging Council. 4. North American/Scandinavian paper-grade market pulp. 5. Canadian Pulp & Paper Assn. †Not annualized. ‡Not directly comparable to year ago because of coding change. (s) = shipments.

SUPPLY/DEMAND (000 tons)



FORECAST (000 tons)

	1983	1984	1985e
Production[1]	4,789	4,875	4,923
Capacity[1]	5,190	5,243	5,322
Utilization rate	92.3%	93.0%	92.5%
Imports[2]	12	28	25
Exports[2]	16	17	18
Apparent U.S. consumption	4,785	4,886	4,930
lb/capita	41.0	41.5	41.5
GNP ratio	3.11	2.98	2.92

1. American Paper Institute data.
2. Commerce Dept. data.
e = Estimate.

TOP U.S. PRODUCERS (000 tpy)

	Annual capacity	Market share (%)
1. Scott Paper	1,035	19.4
2. Procter & Gamble	900	16.9
3. Fort Howard Paper	620	11.6
4. James River	560	10.5
5. Georgia-Pacific	510	9.6
6. Kimberly-Clark	400	7.5
7. Potlatch	300	5.6
8. Crown Zellerbach	285	5.4
9. APL	95	1.8
10. Wisconsin Tissue	91	1.7

Market share of top five companies: **68.1%**
Market share of top ten companies: **90.1%**
Total U.S. capacity (1985): **5.322 million short tons**

Correction. Several errors appeared in the January 1985 Grade Profile for linerboard due to a format change for this page. U.S. industry capacity in 1985 should have been 16.723 million tons, capacity share of the top five producers 39.9%, and share of top ten companies 61.8%.

TISSUE: Healthy market this year; clouds on horizon

Grade structure: Tissue can be grouped into the sanitary sector and "other tissue." Sanitary makes up about 97% of total production. The major sanitary tissue grades are bathroom and facial tissue, towels, napkins and basestock for sanitary stock, wadding, and wipes. "Other tissue" includes basestock for waxing, wrapping, and miscellaneous. Sanitary can be divided into consumer products and commercial/industrial uses. Consumer products make up about two-thirds of sanitary tissue output. Typical basis weights include 12 to 14 lb/3,000 ft² for single-ply bathroom tissue and 32 to 39 lb/3,000 ft² for single-ply towel.

Production/capacity: Tissue producers enjoyed the benefits of economic recovery in 1984 by achieving new production records. This performance was, in fact, unusual for the 1980s—1983-84 was the first time in the decade when the industry put together back-to-back years of increased production (up 8.3% in 1983 and 1.8% in 1984). Generally the tissue industry tracks economic activity, with some moderating effects from population trends, and 1983-84 was no exception.

Production increased by 12.9% between 1980 and 1984, while the number of paper machines in the industry was dropping. Between 1980 and 1982, according to the American Paper Institute, 29 machines were shut down. A total of 264,000 tons of capacity was removed from API lists as a result, and a further 91,000 tons were idled but still listed. API removed a further eight machines, representing 101,000 tons of capacity, from its capacity survey for the 1983-87 period.

Meanwhile, however, new paper machines were installed or announced for the 1983-87 period by Wisconsin Tissue Mills, Fort Howard Paper Co. (two units), James River Corp., and Crown Zellerbach Corp. New machines are expected to produce 332,000 tons of new capacity in 1984-87.

Outlook: The industry seemed likely to continue riding the crest of economic recovery in 1985, but some observers foresee a risk of softness in 1986 due to significant capacity expansions planned, especially if a recession or growth recession occurs. Prices have only just started to rise, and analysts fear the first real increases in three years will be undermined after only a year of consolidation if old machines are not idled in the meantime.

Consumer tissue mills raised quotes by around 5% to 8% for most grades in December 1984, following an attempt in the spring of 1984 to boost prices that was partially undercut by the bane of the '80s: widespread promotional discounting. One factor that may help in 1985, in the view of Smith Barney, Harris Upham & Co. analyst George Adler, is the apparent "180-degree change of strategy on P&G's part," from a seeming "emphasis on market share and volume to an emphasis on profit"—represented by its move away from selective price hikes and toward across-the-board price increases.

Pricing: Price trends tracked by the Bureau of Labor Statistics' producer price index for sanitary papers and health products are as follows (year-end; 1967=100): 1972, 121.5; 1974, 181.1; 1975, 201.7; 1976, 223.5; 1977, 240.7; 1978, 264.3; 1979, 291.0; 1980, 338.8; 1981, 348.4; 1982, 361.0; 1983, 359.7; 1984 (third quarter), 367.4.

Markets: Breakdown of major tissue end-uses is as follows: toilet, 39% (of which 63% is single ply and 37% is multi ply); towels, 32%; facial, 7%; napkins, 12%; wipes, 3%; other sanitary, 3%; nonsanitary, 3%. Nonsanitary tissue shipments have slid from 230,500 tons in 1972 to 106,804 tons in 1982. ■

(News section continues on page 23)

Bowater Newfoundland mill closing on sale set

Sale of Bowater Newfoundland Ltd.'s 272,000-metric-tpy newsprint mill in Corner Brook, Nfld., to Kruger Inc. was expected to go through in December after being delayed for several weeks. A local official said all necessary requirements for transference of ownership had finally been fulfilled. Most recently, an old labor law could have made Kruger liable for an estimated C$6 million in back wages.

Kruger is expected to begin a five-year, $198-million modernization of the mill by April, a company executive said. The provincial and federal governments have agreed to finance 20% of the project. The signing of all documents related to the sale was set for Dec. 21, with Kruger assuming ownership immediately. ■

Boise completes purchase of venture

Boise Cascade Corp. has completed the purchase of substantially all of Sonat Inc.'s interest in their Boise Southern Co. joint venture in a recent transaction which is valued at approximately $200 million (*P&P*, June, p. 25).

Boise Cascade has assumed ownership of the venture's De Ridder, La., newsprint and linerboard mill, wood products plants, 330,000 acres of fee timber, and 290,000 acres of leased timber. Sonat will retain ownership of 110,000 acres of timberland and has obtained oil and gas rights on an additional 400,000 acres of Boise Southern timberland. The agreement provides Boise with harvesting rights on the 110,000 acres taken by Sonat and an option to purchase those lands. ■

EXPANSION

IP labor pact triggers major conversion at Pine Bluff

Union members at six International Paper Co. southern mills ratified a proposal in December to institute separate labor contracts at each facility rather than continue the current practice of negotiating in a multiple unit. "This is an excellent first step in resolving a number of issues that will make it possible for the company to keep the Camden, Ark., mill in operation for at least two years and to recommend major investments of several hundred million dollars in the Pine Bluff, Ark., (shown above) and Moss Point and Natchez, Miss., mills," said David W. Oskin, the company's vice president of human resources.

The company moved quickly to a decision on Pine Bluff. IP said it will install about 200,000 tpy of coated groundwood paper capacity at the mill, with startup scheduled for the second half of 1986. Expenditure on the project is estimated at more than $200 million. A decision on investments at the Mississippi mills is pending, however. Still to be resolved are marketing analyses, favorable engineering studies, financing, and securing environmental permits.

Pine Bluff conversion. To accomplish the plan, IP will convert a newsprint machine at the mill. It is believed that paper machine No. 1, a 120,000-tpy unit, will be converted since the other newsprint unit at the mill, No. 3, can make only 55,000 tpy of paper. No. 1 is a 275-in.-trim unit with an operating speed of about 3,000 fpm.

The two machines were shut down Feb. 7, 1984, as part of a plan to get the company completely out of newsprint (*P&P*, Feb., p. 23). Before the newsprint machines shut down, the company made 64 and 65 brightness groundwood specialties offset sheets there on an experimental basis as part of the process of assessing the mill's future products. The mill also makes about 375,000 tpy of bleached board on a third machine which is being modernized (May 1983, p. 29).

When the Pine Bluff mill was actively making newsprint, the two paper machines were supplied with stone groundwood pulp for 70% of the furnish and semibleached kraft for 30%. The mill has current capacity to produce about 420,000 tpy of bleached and unbleached kraft pulp and 120,000 tpy of mechanical pulp.

John Georges, IP's president and CEO, (who will be moving up later this year to chairman) noted that "coated publication paper is an expanding business and, with this investment, we will be able to make a top-quality product from southern fiber."

Help still needed at Camden. In addition to the favorable union vote on a separate contract, continued running of the Camden mill is still heavily dependent upon assistance and support from state and local officials, primarily in taxes and utility cost areas, according to Peter Redfern, mill manager. The proposal also includes a two-year wage freeze for Camden employees.

"IP officials, Arkansas and Camden officials, and leaders of the United Paperworkers International Union have been meeting together regularly in an attempt to work out the needed relief from tax and utility costs that would put the Camden mill in a more favorable cost position and allow it to compete more effectively," Redfern said. The mill relies heavily on purchased electricity because low-pres-

sure boilers limit its ability to cogenerate power.

Only last November IP announced that it planned to permanently close the 255,000-tpy unbleached kraft paper mill in April 1985, calling the move an "economic decision." However, the company indicated no plans to sell its nine bag and sack converting plants even though closure of Camden would have represented the last of the company's unbleached kraft paper production facilities (Dec., p. 23). This puzzled some industry observers, given the tightness of the kraft paper market due to other capacity withdrawals.

The Natchez mill, which has capacity to produce about 1,100 tpd of bleached kraft dissolving and paper-grade hardwood and softwood pulp, was built in the early 1950s. Moss Point has the capacity to produce about 760 tpd of bleached board and bleached packaging papers on three machines.

Two other IP mills in the former multiple bargaining unit are in Bastrop, La., and Mobile, Ala. ■

North American coated groundwood capacity additions. (Source: *Pulp & Paper Week.*)

	Location	Capacity (000 short tpy)	Time
Announced			
Nitec Paper[1]	Niagara Falls, N.Y.	80	First half 1985
Repap Enterprises	New Brunswick	190	First half 1986
Kruger	Trois Rivières, Que.	80	1985–86
Bowater Carolina	Catawba, S.C.	200	Second half 1986
International Paper[2]	Pine Bluff, Ark.	200	Second half 1986
Consolidated Papers	Biron Div.	175	1987
Under study			
Weyerhaeuser	Columbus, Miss.	175	1987–88
Champion	Sartell, Minn.	175	1987–88
Blandin Paper	Grand Rapids, Minn.	175–200	1987–88[3]

1. Reactivation of idle mill.
2. Conversion of idle newsprint machine.
3. Indefinitely postponed.

Source: *P & P Project Report*

BCFP decides against LWC expansion at Blandin Paper

Despite a robust lightweight coated paper market and widespread expectations of healthy LWC conditions through the end of the decade, British Columbia Forest Products Ltd. has decided not to install a new machine at its Blandin Paper Co. subsidiary.

Expansion of Blandin's Grand Rapids, Minn., mill had been widely expected, and the BCFP decision not to spend the C$300 million required is sure to have a significant effect on market conditions in the closing years of the decade.

BCFP did say a new machine at Grand Rapids is still a "very high priority" for the future. But it pointed to depressed conditions in other product areas where BCFP competes, such as newsprint, market pulp, and wood products, and said it would be "unwise for the company to undertake a project of this dimension until more stability is apparent in the market and higher earnings are achieved." BCFP, like other British Columbia firms, has turned in a poor financial performance in recent years.

A Canadian security analyst who was critical of the decision to junk the expansion commented that this "certainly looks like another mistake" on BCFP's part. He called it the latest in a string of BCFP miscalculations that he believes stretch back to include a muffed plan to build a newsprint mill—later changed to a market pulp facility—in Alberta, and a decision to install a new newsprint machine at Crofton, B.C., in 1982—just when a huge bulge of new capacity was coming onstream.

But BCFP clearly couldn't afford a major project like this now, and it apparently couldn't find ways to finance the expansion without going back to its overstrained lenders. In fact, it was still losing money in the first quarter of 1985, and management presumably felt it should get a few quarters of profits under its belt before taking on any more big challenges. ■

Chesapeake plans switch to corrugating medium

Chesapeake Corp. announced plans last month to modify No. 1 machine at its West Point, Va., mill to produce corrugating medium, a new product for the company. The project is expected to cost $28 million and to be completed by the end of 1986.

Work on the 55-year-old, 228-in.-trim machine, which now produces kraft linerboard, is scheduled to begin in the first quarter of 1986 following the startup of Chesapeake's new 900-tpd No. 3 linerboard machine in late 1985.

The rebuild will include modifying the fourdrinier, installing an incline size press, replacing the press section, and rebuilding the winder. Following the rebuild, No. 1 machine will have the capacity to produce 153,000 tpy of corrugating medium, although the machine will also still be able to produce linerboard, Chesapeake said.

The company will install a new 600-tpd forced secondary fiber processing system complete with high-density screening and dispersion to supply the rebuilt unit. This forced processing system is believed to be the first installation of its kind in the U.S.

The West Point mill currently has capacity for 1,505 tpd of bleached and unbleached kraft pulp and 1,060 tpd of kraft paper and linerboard. Upon completion of the expansion in 1986, mill capacity will total about 2,200 tpd of kraft paper and linerboard, corrugating medium, and bleached hardwood kraft market pulp.

No. 3 linerboard machine is designed to achieve an eventual production level of 1,200 tpd. ■

Port Townsend completes paper machine rebuild

Port Townsend Paper Co. recently released additional details on the modernization program for its Port Town-

INTERNATIONAL TRADE

EEC fines producers in pulp cartel case; appeals expected

Virtually all of the North American companies found guilty in the European Economic Community's three-year pulp price-fixing investigation are expected to appeal the decision, attorneys and executives for the companies told *Pulp & Paper*. The decision, made public Dec. 20, imposes a total of $2.97 million in fines on 36 bleached sulfate market pulp producers, claiming they colluded to fix prices in Europe between 1973 and 1981. Investigations began in 1981.

The EEC commission levied varying fines on each of 15 North American companies, as well as the Pulp, Paper & Paperboard Export Assn. None of those cited had received the text of the decision as of early January, however, learning of it instead through unofficial communications, they noted.

Most of the companies said they will appeal the EEC's verdict to the European Court of Justice in Luxembourg. They must file within 90 days of the time they receive formal notification of the decision. Because of the delay in getting the documents, some companies have not yet definitely decided if they will appeal but most feel it is likely.

The PPPEA is also likely to appeal, said one close source. It was fined separately by the EEC, although a number of the companies cited individually are also members of the association, observers have indicated. The PPPEA, formerly known as the Kraft Export Assn., has lost some members since the EEC investigation was begun in September 1981, including International Paper Co. and Chesapeake Corp. About ten members remain, sources say.

Many of the producers feel the EEC cited many of them for their participation in the PPPEA. But other companies, such as Bowater Carolina Co., were never members of the association. In a statement issued following notification of the EEC's decision, Bowater said it would file an appeal, noting that the EEC's verdict that the producers were guilty of "parallel pricing . . . alone is not an antitrust violation in either the U.S. or Europe."

Other close observers indicated that many of the appeals would include such bases as participation in the PPPEA giving members immunity to antitrust violations since the U.S. Webb-Pomerene Act legalized export cartels. Others note that a parallel investigation conducted by the U.S. Federal Trade Commission in 1982-83 was dropped after evidence of price-fixing was found unsubstantial (*P&P*, July, p. 27).

Conditions cut fines. Fines were reportedly reduced for those companies which agreed to "quote, sell, and invoice in the EEC at least 50% of their bleached kraft pulp in local currency of the buyer" rather than the usual U.S. dollar price, according to the EEC finding. Swedish companies could reportedly sell the other half of their pulp in krona or other EEC currencies; Finnish companies in any currency except the krona or U.S. dollar; and Canadian companies in U.S. dollars and Canadian dollars, or buyer currencies.

EEC fines imposed on major pulp suppliers.

Company	Fine (US$)
Canada:	
British Columbia Forest Products	$72,000
Canadian Forest Products	90,000
MacMillan Bloedel	108,000
St. Anne-Nackawic	144,000
Weldwood of Canada	36,000
Westar Timber	108,000
United States:	
Bowater	360,000
Chesapeake	36,000
Crown Zellerbach	36,000
Federal Paper Board	72,000
Georgia-Pacific	108,000
International Paper	180,000
Mead	36,000
Scott Paper	36,000
Weyerhaeuser	36,000
Pulp, Paper & Paperboard Export Assn.	36,000
Finland:	
Finncell	72,000
Sweden:	
Billerud	36,000
Stora Kopparberg	108,000
MoDoCell	108,000

The largest fines were generally imposed on North American firms, the heaviest falling on Bowater Inc. ($360,000); International Paper Co. ($180,000); St. Anne-Nackawic Pulp & Paper Co. ($144,000); and Georgia-Pacific Corp., Westar Timber Ltd., and MacMillan Bloedel Ltd. ($108,000). Two major Swedish producers were also fined $108,000 (see table). "North American companies were the least guilty but were fined the most for fighting the charges," one Canadian executive complained.

Companies reportedly can still reduce their fines by as much as 90% by agreeing to EEC conditions, which also include not quoting prices on a quarterly or regular, predetermined basis. It was unclear, however, how many companies in North America will agree to selling half their pulp in local currency. One Canadian industry executive estimated that selling in local currency would raise his company's cost of doing business by 3%.

It is uncertain if European customers will buy pulp in other than dollars, especially if the U.S. dollar weakens. A Scandinavian sales organization recently trying to sell pulp in D-marks was reportedly rebuffed by German buyers who wanted to pay in dollars.

Reasons for decision. The commission lists three reasons for its decision, indicating that producers who were found guilty "concerted" in price announcements and charges to customers, exchanged information on pricing, and prohibited the resale or export in the EEC of pulp sold there. (The resale ban may have been in contracts but is largely meaningless since pulp is rarely resold, according to industry observers.)

A Canadian executive close to the case called the local currency stipulation "blackmail," noting that it wasn't part of the EEC's original case and did not relate to the allegations. The EEC, however, feels trading in local currency will "reduce substantially the artificial transparencies of this market, and thus make future concertation more difficult."

Acquittal expected. With the ex-

ception of Bowater's, most of the fines imposed are small, and many of the companies do not appear concerned about them. Most companies, however, do feel strongly about being accused of crimes they say they did not commit and feel certain the Luxembourg court will acquit them.

One observer noted that, while many of the American producers did agree to a "local currency" stipulation that reduced their fines, this was not an admission of guilt. Observers indicate that except for Bowater and IP the U.S. companies agreed to conduct 50% of their pulp sales in Europe in local currencies. None of the Canadian companies agreed, they said.

Many of the 56 producers worldwide named initially in the EEC's investigation were not cited in the final decision, which included a list of 43 in the U.S., Canada, Sweden, and Finland. Companies dropped from the case were the Canadian producers Domtar Inc., Consolidated-Bathurst Inc., and Thurso Pulp & Paper Co. and U.S. companies Allied Paper Co. Inc., Brown Co., Brunswick Pulp & Paper Co., Buckeye Cellulose Corp., ITT Rayonier Inc., Parsons & Whittemore Inc., Temple Eastex Inc., and Western Kraft Paper Group.

Among the companies which plan to appeal are: Bowater, Canadian Forest Products Ltd., Crown Zellerbach Corp., Federal Paper Board Co., MacMillan Bloedel Ltd., Mead Corp., Westar Timber Ltd., and lastly, Weyerhaeuser Co.

The following companies indicated they were likely to appeal but were still undecided: British Columbia Forest Products Ltd., Chesapeake Corp., Georgia-Pacific Corp., International Paper Co., as well as the Pulp, Paper & Paperboard Export Assn.

Unavailable for comment were St. Anne-Nackawic Pulp & Paper Co. Ltd. and Weldwood of Canada Ltd. ■

EEC, Canada end dispute on duty-free newsprint quota

Canada and the European Economic Community have agreed to a tariff-free quota of 600,000 metric tpy for newsprint imported into the EEC beginning in 1985, ending talks begun in mid-1983, observers reported.

Although the level is 150,000 tpy lower than that most recently sought by Canada, and below the amount Canada has exported to Europe in recent years, it is well above the projected 1984 figure. According to the Canadian Pulp & Paper Assn., Canada exported 485,300 tons during the first 11 months of 1984 compared with 617,300 tpy during the same period a year earlier.

Talks between Canada and the EEC commission began a year and a half ago in an attempt to reduce the existing 1.5-million-tpy quota beginning January 1984, when tariffs on Scandinavian newsprint were to be eliminated under a previous agreement. Scandinavia and Canada supply virtually all newsprint imported into Europe.

Late last year, a special arbitration panel ruled that the EEC was obligated to negotiate a new quota with Canada (*P&P*, Jan., p. 37). In January 1984, the commission imposed a 500,000-tpy level without Canada's consent but later increased it to 635,000 in two actions initiated by some EEC countries concerned about a shortage of newsprint.

Some Canadian paper industry observers are satisfied with the new quota, indicating that while it is lower than the newsprint exported in some prior years, shipments this year would have been below normal levels anyway due to falling demand, unfavorable exchange rates, and new British newsprint production that has cut into Canadian export markets. Others fear the new quota could severely curtail their markets in the long run, however. No provision was made to renegotiate the quota if demand should pick up. ■

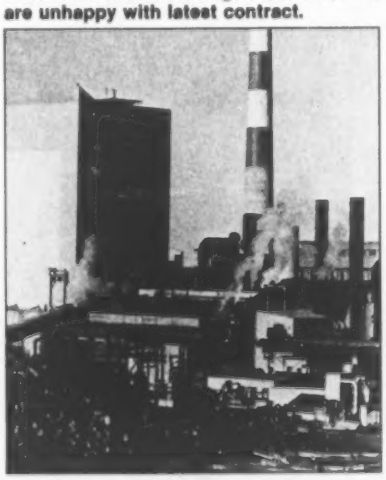
LABOR

"Massive" wage cuts imposed at ITT mill

Contract negotiation talks have recessed for some time on the West Coast, with strikes at Crown Zellerbach Corp.'s West Linn, Ore., mill and California Paperboard Corp.'s Santa Clara, Calif., mill continuing with no end in sight, observers reported (*P&P*, Jan., p. 37).

At ITT Rayonier Corp.'s Port Angeles, Wash., mill, the Assn. of Western Pulp & Paper Workers released details of an offer the company implemented recently despite earlier union rejection of the offer. Noting that the contract contains "massive takeaways," the union said labor's wages would be decreased by 10%/4.7%/4% over a three-year period expiring January 1988. Also, benefits such as vacations and call time would be reduced.

Workers at ITT's Port Angeles, Wash., mill, are unhappy with latest contract.



California Paperboard Corp. also imposed its final contract offer despite rejection by AWPPW workers there, and early in January was considering hiring replacements for the strikers, an industry spokesman said. The mill has been on strike since Sept. 21, but has operated one machine during much of the walkout. The contract calls for pay hikes of 35¢/40¢/35¢ over three years.

• In the meantime, **Louisiana-Pacific Corp.**'s Ketchikan, Alaska, mill came back up in December after being down since June 29 due to lack of orders, observers reported.

The contract negotiations with the AWPPW continued with no job action imminent, although members earlier gave strike authorization should talks break down. The two sides are set to return to the bargaining table on Jan. 14 under the auspices of a federal mediator, the AWPPW reported. ■

Wage settlements: a downward spiral

The Conference Board, a business-funded research group, predicts that first-year wage and benefit gains in union contracts will average about 4% in 1985, significantly less than the 5% inflation the Board expects and well below the 6.5% average pay increase that many compensation specialists are anticipating for salaried employees.

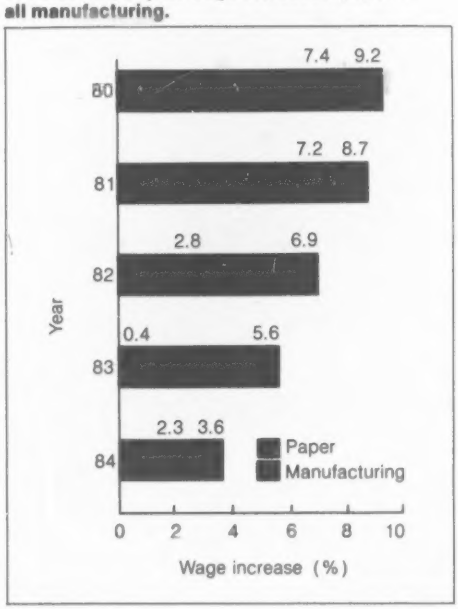
TOO SUCCESSFUL. 1985 will be a modest year for the collective bargaining calendar, with approximately 2.4 million workers' contracts up for renegotiation. A new member of the bargaining committee seems to have appeared this year—international competition. Foreign competitors increasingly cause the American worker concern over being "too successful" at labor negotiations. If companies are to remain competitive, they must eliminate contract provisions that restrict productivity, and unions must recognize the facts of economic life in the U.S. in 1985. Of the 102 million people employed, the number represented by unions is continuing to decline. Most recent data indicate that less than 20 million employees (17.9% of the civilian work force) rely upon unions in negotiations with their employers. As deregulation continues, the role of the nonunion worker is becoming more important, as corporations with unionized work forces seek ways to compete effectively. The experiences of the trucking, rubber, and airline industries are cases in point.

In 1985 six airlines, the Teamsters, and the rubber workers—and toward the end of the year, American Motors and Chrysler—will be negotiating new agreements. GE and Westinghouse will bargain this summer—and their contracts should be bellwethers, in light of the companies' bargaining histories. When GE last bargained in 1982, it was one of the few companies from a major smokestack industry (other than the paper industry) that did not seek a concession-oriented agreement. As a result, wage costs have climbed by almost 20% and may now be in a position for further adjustment.

Paper industry wages have continually outpaced those of the manufacturing sector (FIGURE 1). Of particular significance is the 1982-83 period when most of American industry was bargaining for concession agreements—and the paper industry continued with its generous ways. Although its 1984 wage settlements seem to be more in line with the rest of American industry, the paper industry wound up with 5.2% in wage increases in the past year—discounting those companies who gave no wage increases—a level far in excess of the reported increase in inflation.

One interesting aspect of paper industry employment is that it actually pays *more* for less time worked (including vacation time, holidays, sick pay, etc.) than any other major industry (e.g., chemicals, petroleum, primary metals, etc.) in the U.S. And because the paper industry's labor contracts are usually effective for two or three years, its bargaining will affect the industry for several years to come. Other industries are approaching the need to lower wages more aggressively. Evidently the paper industry considered itself relatively immune from foreign competition, but the unusually strong U.S. dollar has attracted foreign competitors to the U.S. market. What this will mean for 1985, with its significant bargaining calendar in the South and the Midwest, will be interesting. With most economists predicting 1985 inflation at a relatively modest 4% to 4.5% along with the tightening of the international market, chances are better than average that the downward spiral in wage and benefit settlements will continue.

FIGURE 1: **First year wage increases: paper vs all manufacturing.**



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CROSS-DIRECTION CONTROL IS STILL TOP PROCESS AUTOMATION TREND

Recent survey found 960 systems had been installed at the end of 1984; paper industry has spent $500 million with no letup in sight

By KENNETH E. SMITH, Executive Editor

■ The availability of reliable, accurate sensors, sophisticated control schemes, and a variety of actuators, combined with the obvious benefits, have made cross-direction (CD) paper machine control of moisture, basis weight, and caliper the dominant process automation trend of the 1980s. The pulp and paper industry has invested more than $500 million in CD control, most of it in the last five years. By the end of 1984, an estimated total of 960 computer-controlled CD systems (caliper, moisture, and basis weight each count as one) had been installed in the industry worldwide.

The benefits of CD control have been well documented. CD control was first applied to newsprint but is applicable to all grades. Producers of newsprint, uncoated free-sheet, and other highly competitive grades have found that CD control is required to produce the quality demanded by their markets. Producers of other grades have found CD equipment readily justified by payback periods of three to six months. Savings of up to $3 million/year have been documented for machines with "total" (weight, moisture, and caliper) control. Adding total cross-direction control to existing machine-direction control systems is said to cost about the same as the original machine-direction control system, while the typical economic benefits of CD control are reportedly twice those of machine-direction control. Table 1 summarizes benefits claimed for CD.

TABLE 1: **Claimed benefits of cross-direction control.**

Results	Fine paper	Newsprint	Brown grades
Reduced rejects (%)	40 to 60	50 to 75	15 to 30
Decreased fiber use (%)	1 to 3	2 to 4	3 to 5
Reduced additives use (%)	5 to 10	—	—
Steam savings (%)	3 to 5	1 to 4	5 to 8
Increased speed (%)	3 to 5	3 to 5	5 to 12
Reduced breaks (%)	30 to 40	30 to 40	30 to 50
Reduced chemical furnish (%)	—	1 to 4	—
Increased trim (in.)	—	1 to 5	—
Increased coater speed (%)	1 to 4	—	—
Improved winder performance			
Fewer breaks (%)	40 to 60	50 to 75	30 to 50
Fewer rewinds (%)	50 to 60	50 to 70	—

CALIPER WAS FIRST. Caliper control is the oldest and most common form of CD control and was first used in the mid-1970s (Figure 1). Newsprint producers have found that they need this control (and twin-wire forming) to produce the quality demanded by today's publishers. Moisture profile control has gained popularity in recent years because this application is probably the easiest to justify economically. Moisture controls led the other applications in number of installations in both 1983 and 1984 (Figure 2).

Basis weight control is the newest and least common of the three applications because it is the most difficult and requires complex control algorithms (Figure 3). However, AccuRay and Measurex have developed sophisticated "dynamic" or "self-tuning" control models, and Sentrol has been licensed to use the model developed by STFI in Sweden to control cross-direction basis weight. Basis weight control is potentially the most profitable since it affects moisture, caliper, and other sheet properties.

A CD control system is made up of three components: a scanning gauge for measuring the cross-direction parameters to be controlled; a process control computer for displaying the cross-direction profiles, running the control algorithms, and controlling the actuators; and the actuator system itself, which is designed to correct profile variations. Three vendors—AccuRay, Measurex, and Sentrol—have dominated process computer and sensor sales in this market. Robin is now selling Lippke sensors and is offering CD control but the company does

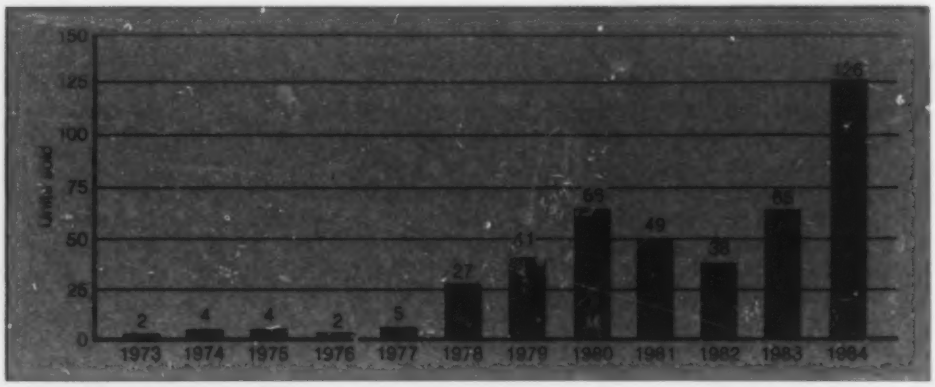


FIGURE 1: **Caliper cross-direction control sales by year.**

not yet have an installation in North America. Lippke has CD control installations on 12 paper machines in Europe, however.

Competition between the vendors for CD control system sales is as fierce as it has traditionally been for machine-direction and other control system sales. In 1984, AccuRay sold 160 systems while Measurex sold 208. In 1983, AccuRay reported 82 systems sold to Measurex's 99. Sentrol sold eight systems in 1983 and 18 in 1984. Cumulative CD control system sales in 1983 were double those in 1982, and reported CD control system sales in 1984 doubled compared with 1983, indicating the momentum of this trend. Measurex leads all vendors with 548 cross-direction control systems sold through 1984 and has been particularly successful with newsprint applications in Canada.

With approximately 2,500 paper machine computer systems installed worldwide and assuming an application potential of two cross-direction controls per machine, the total 960 CD control systems sold at the end of 1984 represents only about 20% of the potential retrofit market. Acceptance of CD technology is now so widespread that almost every new paper machine started up in the past two years has at least one cross-direction control.

ACTUATOR EQUIPMENT. While the sensor and process computer market for CD control is dominated by three companies in North America, more than 20 companies supply actuators (Table 2). Most of these systems are designed to operate on a stand-alone, manually controlled basis or to interface with a process control computer. Measurex supplies its own actuators for basis weight and moisture control in what it calls "single-vendor responsibility," or its control sytems can be interfaced with actuators supplied by other vendors. AccuRay supplies air showers for caliper control and has signed technology-sharing agreements with Devron Engineering, Midland-Ross, V.I.B. Systems, and Beloit. Actuators supplied by these companies are recommended and installed by AccuRay in turnkey CD control installations. Sentrol supplies no actuators but indicates a preference for Devron equipment.

Cross-direction caliper control actuators are based on the principle of increasing nip loading in the calender stack at selected cross-direction segments by varying the diameter of one or more calender rolls. Hot and cold air showers supplied by AccuRay, Lodding, and Midland-Ross are the most popular type of caliper actuator. However, controlled deformation rolls, such as Sulzer Escher Wyss's NIPCO roll and induction heating, are becoming

FIGURE 2: **Moisture cross-direction control sales by year.**

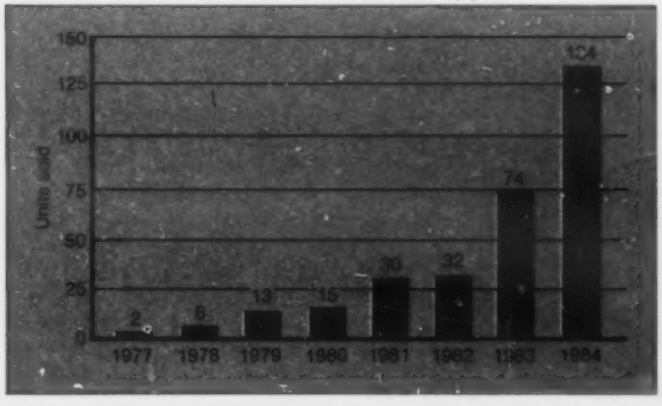


FIGURE 3: **Basis weight cross-direction control sales by year.**

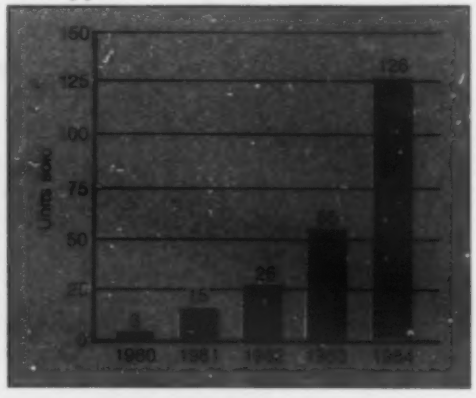


TABLE 2: **Cross-direction actuator vendors.**

Actuation principle	Vendor	Type	On Reader Service Card circle
Weight profile actuators			
Motorized slice lip			
	Ahlstrom	Mech. drive w/slice position feedback	401
	Beloit	Mech. drive w/slice position feedback	402
	Black-Clawson	Mech. drive w/slice position feedback	403
	Devron	Mech. drive w/slice position feedback	404
	Kobeyashi	Mech. drive w/slice position feedback	405
	Sulzer Escher Wyss	Mech. drive w/slice position feedback	406
	Tampella	Mech. drive w/slice position feedback	407
	Voith	Mech. drive w/slice position feedback	408
Thermal-hydraulic			
	Devron	Expand. fluid w/slice position feedback	409
Thermal expansion			
	Measurex	Expand. metal, no slice position feedback	410
Guidance			
	AccuRay	Operator makes slice position changes	411
	Sentrol	Operator makes slice position changes	412
Moisture profile actuators			
Steam box			
	Bergstrom	Fourdrinier, couch, press	413
	Measurex	Fourdrinier, couch, press	414
	Midland-Ross	Fourdrinier, couch, press	415
	Wallace Products	Fourdrinier, couch, press	416
Water spray			
	Devron	Water pressure atomized	417
	Measurex	Water pressure atomized	418
	Midland-Ross	Water pressure atomized	419
	V.I.B. Systems	Air atomized	420
Controlled deformation roll			
	Beloit	Multizone press roll	421
	Farrell	Multizone and swimming roll	422
	Kleinewefers	Multizone press roll	423
	Kusters	Multizone press roll	424
	Sulzer Escher Wyss	Multizone and swimming roll	425
	Voith	Swimming roll	426
Segmented infrared dryers			
	Eclipse	Gas	427
	Impact	High-temperature electric	428
	Technmark	Gas	430
Magnetic induction			
	Beloit	Eddy current heating	431
Segmented air systems			
	AER-Overly	Hoods and pocket ventilation	432
	Airtech	Hoods and pocket ventilation	433
	Enerdry	Hoods and pocket ventilation	434
	Sulzer Escher Wyss	Hoods and pocket ventilation	435
	Midland-Ross	Hoods and pocket ventilation	436
Caliper profile actuators			
Air showers			
	AccuRay	Cold air/heated roll, proportional air flow	437
	Beloit	Cold air, proportional air flow	438
	Enerdry	Hot and cold air, constant flow	439
	Impact	Infrared heating, constant air flow	440
	Lodding	Cold air, pulsed air	441
	Midland-Ross	Hot and cold air, constant flow	442
	Valmet	Cold air, proportional flow	443
Magnetic induction			
	Devron	Pulsed eddy current heating	444
Controlled deformation roll			
	Beloit	Multizone calender roll	445
	Farrell	Multizone and swimming roll	446
	Kleinewefers	Multizone calender roll	447
	Kusters	Multizone calender roll	448
	Sulzer Escher Wyss	Multizone and swimming roll	449
	Voith	Swimming roll	450

more commonly used in caliper control. A system for infrared caliper actuation has also been introduced.

AccuRay reports that in 1984 53% of its caliper controls used air showers, 30% used induction heating, and 17% used controlled deformation rolls. Prior to 1984 these applications were 78%, 18%, and 4%, respectively. In 1984, 50% of Sentrol's caliper controls utilized air showers, 25% featured induction heating, and 25% of them used infrared heating. Devron's Cal-Coil caliper actuator, which is based on induction heating, and Impact Systems' infrared caliper actuator will be discussed below.

Actuators for basis weight control can be grouped into three types: thermal expansion, thermal-hydraulic, and motorized. These actuators are added to or replace existing slice jacks to control slice position across the machine. Electrically heated thermal expansion rods are preferred by Measurex and offered as the Thermatrol system. Thermatrol utilizes Equilex rods developed by Chleq Frote, France. Equilex rods are hollow stainless steel rods that are engineered to replace existing slice rods. When a high-speed duty cycle current is passed through a low-voltage heating element inserted in the rod, the rod heats and expands. At the end of 1984, 130 of Measurex's Thermatrol systems had been sold, which represent 97% of the company's basis weight control installations.

Almost all headbox manufacturers offer motorized slice adjustment screws for their headboxes. In addition, Ahlstrom, Beloit, and Devron offer motorized systems for installation on practically any headbox. Beloit has sold 29 of its Belcomp systems, while Ahlstrom has sold six Alpro systems.

Devron offers its Auto-Slice system with either motorized or thermal-hydraulic slice jacks. According to Devron, the thermal-hydraulic actuator uses thermal expansion of a fluid to translate power input into linear movement of the spindle rods. The large range of response is not limited by physical constraints or variations in ambient conditions. Several optional features may be incorporated: a solenoid valve to lock the last lip position in power-down conditions and ensure bumpless startup; a force limiter to safeguard against lip deformation; and a position transmitter (L.V.D.T. type) to monitor actuator movement and enhance computer control. Since 1981, more than 35 Auto-Slice systems have been sold.

AccuRay reports that 52% of its basis weight control installations in 1984 utilized thermal-hydraulic actuators, while 42% of its installations were equipped with motorized slice jacks. The remaining 6% were "guidance" systems where all actuator setpoint changes are done by the operators rather than by a computer.

In all AccuRay basis weight control installations prior to 1984, 41% utilized thermal-hydraulic actuators, 44% included motorized jacks, and 15% were guidance. Sentrol reports that 75% of its basis weight controls sold in in the year 1984 use thermal-hydraulic actuators and 25% are guidance.

MOISTURE CONTROL. Moisture profile control is most commonly accomplished with segmented steam boxes, sheet rewetting sprays, and infrared drying systems. The most popular steam boxes are Measurex's Steamtrol and the Devronizer, which was developed by Devron and is marketed by Midland-Ross. Measurex supplied a total of 25 Steamtrol units, 14 of which were sold in 1984. More than 200 Devronizer units have been sold in the past two years.

Steam boxes are used on the fourdrinier, couch, or press section to increase sheet temperature by 70°F to 85°F in selected areas--usually 3-in. segments--which approximately halves the viscosity and surface tension of the sheet's water for easier removal in the presses. Moisture reductions of up to 5 percentage points are said to be possible.

Measurex says the cost of adding a Steamtrol system to an existing process measurement and control system is $200,000, which is typically paid back within six months. A payback period of 12 months or less due to increased production and/or improved moisture profile is normally guaranteed for Devronizers. Payback periods are said to average about three months.

The most popular sheet rewetting systems are supplied by Measurex (Aquatrol) and V.I.B. A total of 101 Aquatrol systems have been sold, including 45 sold in 1984. V.I.B. reports more than 100 installations since 1978, with 16 CD control installations in 1984 (see p. 84 of this issue).

Devron also offers its Hydro Profiler system and reports nine orders from North America. These systems are installed in the dryer section and add an extremely fine spray of water to 4- to 6-in. increments of dry areas in the sheet to even the moisture profile. Sheet moisture increases of 7 percentage points are claimed. The Aquatrol and Hydro Profiler systems are water pressurized, while the V.I.B. system is air atomized.

Devron claims that its Hydro Profiler, operating in conjunction with a Devronizer, is a net energy-saving system that can deliver a moisture profile with 2 sigma spreads of 0.2 percentage points at 8% average moisture. Measurex claims that the cost of adding an Aquatrol system to an existing process measurement and control system is about $200,000 with a six-month or less payback period.

Based on data supplied by AccuRay, Measurex, and Sentrol, 41% of all moisture control installations in 1984 utilized steam boxes, 49% used rewetting sprays, and 10% utilized infrared drying systems. Infrared systems will be discussed in more detail below. Some other forms of moisture profile control include NIPCO press rolls, segmented yankee dryer hoods, and pocket ventilation systems.

SEGMENTED INFRARED DRYING. In North America two methods of drying with infrared (IR) radiant heat are being used. Gas-fired emitters for CD control and coating drying applications, offered by Techmark and Eclipse, are currently running on 20 paper machines.

Electrically generated radiant heat systems, sold by Impact Systems, are online at more than 35 installations. Equipment is custom fit to specific applications (systems are drying all grades of coated and uncoated paper and paperboard) and can be linked with existing process control equipment.

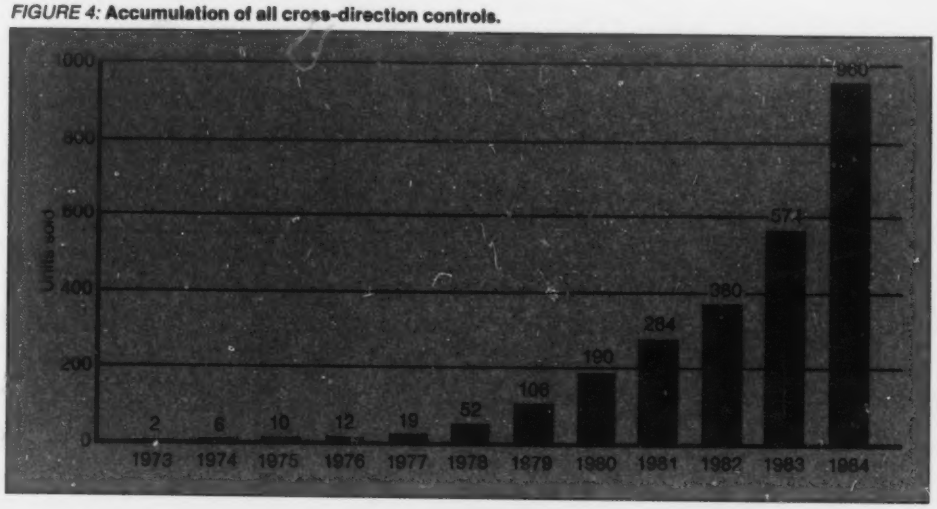
Increased production for dryer-limited applications seems to be their chief benefit and the major factor in determining the payback time for the units. Moisture variations have been significantly reduced (50% to 80%) at a number of locations (see p. 86 and p. 88 of this issue for details of two such installations).

The benefits of uniform moisture profile are not always easy to measure in monetary terms but, generally, finishing and converting operations of the product are said to be improved and customer quality complaints are reduced. Mills are able to sell more water, as moisture targets can often be increased 0.5% to 1.5% without any drastic changes in moisture profile or quality. Other reported advantages of IR drying are dryer section steam savings as well as reduced coating migration and press picking.

Electrical IR dryers and gas-fired dryers fit similar positions. The major difference between the two methods (other than energy source) is the temperature at which they operate. The Impact unit uses a fine tungsten wire heated to 4,000°F inside a lamp filled with halogen gas contained by quartz plates. The Techmark system utilizes natural gas combustion to heat nickel chrome plates to 2,100°F.

Both systems have air circulation. Impact showers cool air inside the profiler through slits in the quartz plates. Techmark has air inlet and outlet streams running countercurrent to the sheet, with 75% of the inlet air being recycled. Interfacing to CD process control computers has been achieved at some locations but the data

FIGURE 4: **Accumulation of all cross-direction controls.**



links and the software needed have not been available at other installations.

Prices for these systems vary with the size of the paper machine, number of profilers, and the application involved, but reports from mills with the systems installed generally fix capital investment at $100,000 to $700,000. The quickest payback reported is four months, and most mills see a full return on investment after about six months operation. New orders are frequently announced by the vendors, and sales should remain brisk through 1985.

Infrared drying in the paper industry has always caused concern among management over potential fire hazards. The emitters apply immensely concentrated heat directly to the fairly volatile paper web. Therefore, internal systems are required that would act immediately in case of fire or web break. Each system has automatic source-terminating mechanisms linked with detection devices that will rapidly cool down the emitting surfaces. Mills with infrared systems have often added other equipment or procedures designed to work with the drying systems.

Impact also has recently begun marketing an infrared-based system for caliper control called the Therma-Jet. Eleven have been sold since its introduction in late-1984. A control range three to six times that of conventional air systems is claimed for the Therma-Jet. Narrow control zone resolution of three inches and efficient heat transfer are other reported benefits.

Individually controlled IR units heat continuously operating air jets, which are then directed in an annular direction around a calender roll. According to Impact, a 22°F change in any control zone can take place in 6 to 8 min. Cooling is accomplished with room-temperature air, and no chiller is required. Cooling is said to occur much more rapidly than with induction-heated systems.

INDUCTION ENERGY SYSTEMS. Devron has had considerable success marketing the CalCoil unit for cross-direction caliper control. The system, which was developed by Consolidated-Bathurst, uses induction energy to heat a calender roll in individually controlled segments. An eddy current is induced in the roll, and resistance to this current causes roll surface heating. Segmented elements powered by a.c. current--called Work Coils--neither contact the roll nor heat up.

A recent installation reported reductions in caliper profile variations of 90% since the CalCoil replaced cold air showers and friction pads previously used on the calender stack, bringing caliper variations down to 0.02 mils (2 sigma). The benefits were said to include 64% fewer roll rejects due to hardness related reasons. Since it was introduced in 1983, more than 70 CalCoil systems have been sold--66% of which were sold in 1984.

Beloit offers its ECAMP (Eddy Current Automatic Moisture Profiler) for tissue machine applications. The ECAMP utilizes d.c. current and segmented electromagnets to selectively heat the yankee dryer shell for moisture profile control (see p. 77 of this issue for more details). Four ECAMP systems have been installed worldwide.

WHERE TO NEXT? Vendors feel that every cross-direction control system in the industry is a candidate for a CD retrofit. One recently stated that "any machine that cannot justify a cross-direction control installation will not be economically viable in five years." Future developments in this field will be faster, more accurate sensors, improved control algorithms, and more energy-efficient actuators. Many machines in the future will have integrated installations of all three cross-direction controls. Other parameters such as formation, gloss, and strength may also be controlled.

All numbers included in this article come directly from the equipment suppliers. Special thanks to Bob Kirsch of Weyerhaeuser, Tacoma, Wash., for sharing the results of an internal study he conducted on process control trends. For more information on available CD control systems, please contact the vendors directly, or use the reader service numbers shown in Table 2. ■

Chlorine output/demand grow, but prices remain steady

By BARRY SHOCKETT

Chlorine production and demand have continued to rise since 1982. Production growth was estimated at 10% last year, as the industry increased its operating rate to 80% (from 75% in 1983). The rise in total demand was also pegged at 10%. At the end of August 1984, chlorine output was up almost 10.5% compared with the same period in 1983.

U.S. statistics, chlorine (000 short tons)

	1981	1982	1983	1984e
Capacity	14,300	14,500	13,300	13,600
Production	10,558	9,176r	9,960	10,925
Imports	181.5	217	237	275
Exports	50.5	35	64	35
Apparent consumption	10,689	9,378r	10,133	11,165
Pulp and paper	1,400	1,200	1,300	1,450

r = Revised. e = Estimate. Sources: Bureau of Census, U.S. Dept. of Commerce; *Pulp & Paper* industry estimates.

Canadian statistics, chlorine (000 short tons)

	1981	1982	1983	1984e
Capacity	1,652	1,680.5	1,680.5	1,680.5
Production	1,424	1,360	1,527	1,600
Imports	27	23.5	47	25
Exports	181.5	217	237	275
Apparent consumption	1,269.5	1,166.5	1,337	1,337
Pulp and paper	562	501.5r	548	571

r = Revised. e = Estimate.

CHLORINE

UNITED STATES

Uses: Chlorine's major use by the pulp and paper industry is for bleaching kraft and sulfite pulps.

Demand: In 1984, the pulp and paper industry used an estimated 1.45 million tons of chlorine (13% of total demand), compared with 1.3 million tons the year before. The largest end-use is for EDC production.

Sources: At least 25 companies in the U.S. produce chlorine and caustic. The major chlorine producers (in descending order of nameplate capacity) are Dow Chemical, PPG Industries, Diamond Shamrock Corp., Occidental Chemicals, Olin, LCP, Georgia-Pacific, Vulcan Materials, Convent Chemical, and Pennwalt. Imports, all from Canada, were an estimated 275,000 tons in 1984, up about 38,000 tons from 1983.

Availability: Several plant closures during the past couple of years, together with some expansions, has brought the actual industry capacity to about 37,260 tpd (39,700 tpd in 1982). However, as caustic demand picked up in 1984, the tight chlorine situation eased. 1984, tight to market; 1983, market to tight; 1982, market; 1981, market; 1980, market; 1979, tight to very tight.

Pricing: Chlorine prices continued to rise in 1984, but to a lesser extent than was the case in 1982-83. A $15/ton boost on Jan. 1, 1984 was followed by a $25/ton hike at the end of March. Pricing history: 1984, $175-$200/ton, f.o.b. works, freight equalized; 1983, $145 to $175/ton; 1982, $145/ton; 1981, $145/ton; 1980, $145/ton; 1979, $135-$150/ton; 1978, $135-$145/ton.

Forecast: Over the long term, pulp-mill chlorine use will gradually decrease as ClO_2 substitution increases. However, 1985 pulp mill usage should surpass the 1.5-million-ton level if growth in pulp output this year matches 1984. By the end of August 1984, market pulp production was 6.8 million tons on an annualized basis (up 5.5% over 1983).

CANADA

Uses: Chlorine's major use by the pulp and paper industry is as a bleaching agent in kraft and sulfite pulp mills. Additional quantities are consumed in onsite hypochlorite makeup.

Demand: An estimated 571,000 tons of chlorine were required by the pulp and paper industry in 1984, an increase of 23,000 tons from 1983. The industry's share of total demand was about 42% in 1984 vs 44% in 1981. It dropped slightly in 1983 to 41% from 43% in 1982. The largest end-use last year was in the production of EDC, which made up 45% of the total.

Sources: Major merchant producers include (in descending order of nameplate capacity) Dow Chemical Canada, C-I-L, Canadian Occidental Petroleum, PPG Industries Canada, and lastly, FMC Chemicals. The four captive producers are Canso Chemical, Great Lakes Forest Products, Prince Albert Pulp (Saskatoon Chemicals), and St. Anne Chemical.

Availability: Although domestic demand was up in 1984 and the industry operating rate rose to 95%, no shortages were anticipated in the immediate future. 1984, market; 1983, market; 1982, market; 1981, market; 1980, market; 1979, tight.

Pricing: There were no boosts in chlorine tags during 1984, the July 1, 1983 price remaining in effect all year. Pricing history is as follows: 1984, $344.75/ton, bulk, f.o.b. works; 1983, $308.45 to $344.75/ton; 1982, $254-$281/ton; 1981, $225-$254/ton; 1980, $195-$225/ton; 1979, $163-$195/ton.

Forecast: No chlorine price hikes are expected before mid-1985. Despite the slight decrease in bleached kraft output at the three-quarter mark in 1984 (a 2% drop vs 1983), chlorine usage by the mills last year probably rose about 4%. Continued recovery in pulp markets should boost mill consumption to the 590,000-ton level in 1985. Over the long term, chlorine usage will be reduced by ClO_2 replacement.

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